

REMARKS

Applicants appreciate the thoroughness with which the Examiner has examined the above-identified application. A complete listing of all the claims in the application is shown above showing the status of each claim. Reconsideration is requested in view of the amendments above and the remarks below.

Claims 10 and 21 have been amended. Support for the amendments can be found in the specification on page 7, lines 9-10; page 7, line 24 to page 8, line 2 and page 9, lines 11-18.

No new matter has been added.

35 USC 103 Claim Rejections

Claims 10, 13-21, 23-27 and 29 have been rejected under 35 USC 103(a) as being unpatentable over U.S. Patent No. 5,478,780 to Koerner et al. in view of U.S. Patent No. 5,043,299 to Change et al. in view of U.S. Patent No. 4,966,519 to Davis et al. in view of U.S. Patent No. 4,911,597 to Maydan et al.

Applicants continue to submit that the present invention is directed to, in a first aspect, an apparatus for selectively forming a silicide, and in a second aspect, a system for selectively forming a silicide on a surface of a semiconductor substrate. The invention includes a mainframe having at least an interior cleaning chamber for removing oxide from a surface of a substrate while under a continuous vacuum, and at least an interior

deposition chamber for depositing a metal on the surface of the substrate while under the continuous vacuum. The mainframe includes a pump for evacuating the mainframe to maintain the continuous vacuum such that this continuous vacuum is a constant vacuum throughout the mainframe and each of its interior cleaning and deposition chambers during selective silicide formation.

Further, a workpiece holder is within the mainframe for holding the substrate. Also within the mainframe is an input line for providing a chemical agent into the interior cleaning chamber for removing the oxide while under the continuous vacuum, as well as an output line for removing the cleaning agent and removed oxide from the cleaning chamber and the mainframe.

The deposition chamber has therein a reactor for depositing metal onto silicon and insulator portions of the substrate surface while under the continuous vacuum. The apparatus and system further include a heating element for heating the substrate to an elevated temperature to form a silicide over the silicon portion of the substrate surface by reaction with the metal deposited thereon, while the metal remains unreacted over the insulator portion, and an etchant to remove such unreacted metal. This heating element may either be external to the mainframe or may be enoused within the mainframe.

In the above office action the Examiner continues to take the position that "Koerner et al. disclose an apparatus for forming a silicide on a surface of a silicon (col. 4, row 59) semiconductor substrate, comprising a plurality of interior chambers (Fig. 1, 1-6; abstract) in which multiple method stages (including removing an oxide using a cleaning

agent, depositing a metal layer, etching and heating) can be carried out at high vacuum without interruption (col. 5, rows 1-10). The Examiner even states, with respect to claims 13 and 18, that at least one interior chamber is adapted to heat said substrate (col. 5, rows 9-10), and respectively, the interior chamber adapted to deposit said metal on said surface of said substrate is a vapor-sputtering device (col. 3, rows 35-36).

However, as previously submitted and as recognized by the Examiner at page 4, paragraph 14, of the above office action, both Koerner et al. and Chang et al. fail to teach that the interior processing chambers are located inside a vacuum buffer chamber (mainframe), as is currently claimed. Koerner et al. does not disclose "interior chambers," and as such, it does not and can not disclose interior chambers having inlet and outlet lines within an interior cleaning chamber while under continuous vacuum as claimed

Again, it is submitted that Koerner et al. is limited to separate, independent processing chambers, i.e., chambers 1-6, 8, 9, which are all connected by a central distributor chamber 7 that is insulated from and independent of chambers 1-6, 8, 9. (Fig. 1, col. 4, lines 42-51.) Additionally, any removed oxide within chamber 1 of Koerner would redeposit onto the substrate as such chamber only has an input line and no output line as is currently claimed.

The Chang et al. patent is cited for structural deficiencies of Koerner et al. Particularly, the Examiner states that Chang et al. discloses a workpiece holder (Fig. 1, 16); at least one input line adapted to provide a chemical agent into said chamber (22); at least one output line adapted to remove said cleaning agent (26); a heating element (15,

45) in said chamber adapted to heat said substrate to an elevated temperature; and a reactor adapted to deposit a metal (50). Yet, Chang et al. is also limited to a system having separate, independent processing chambers connected by intermediate bodies, i.e., cleaning chamber 10 and CVD chamber 40 that are connected to each other by an air-tight passageway 70. (Fig. 2, col. 2, lines 64-67).

At page 4, paragraphs 13-15, of the above office action the Examiner takes the position that Koerner et al. and Chang et al. disclose the invention substantially as claimed, including isolating the chambers from an outside environment; however, that these cited references fail to teach placing interior processing chambers inside a vacuum buffer chamber.

To overcome such deficiencies the Examiner now cites Davis et al. stating that it teaches a way for wafers to be transferred from one processing station to another without ever exposing them to pressures higher than 10^{-5} torr for the purpose of preventing them from exposure to airborne particulates, vastly reducing the possibilities for particulate collection on wafers (col. 3, rows 28-41); and that this teaching is facilitated by having a process module 102 (Fig. 5) that contains processing stations 104.

Applicants submit that Davis et al. does not remedy the deficiencies of Koerner et al. or Chang et al., alone or in any proper combination thereof. With respect to the Davis et al. patent, and in particular, Fig. 5, it discloses two load locks 12, transfer arm 28, and a process module 102 that contains four process stations 104. However, unlike the present invention, the process module 102 of Davis et al. is not configured with a

continuous vacuum such that it is "a constant vacuum throughout said mainframe and each of said interior cleaning chamber and said interior deposition chamber during said selective silicide formation." (Claims 10 and 21.)

Rather, Davis et al. actually discloses breaking the vacuum within its process. Particularly, it discloses that the transfer arm 28 from one of the load locks 12 picks up and places a wafer to be processed in one of the process stations 104. The arm is retracted and then the process station 104 is sealed off from the main process module 102 for processing the wafer. " When a wafer in a module 104 has completed processing, that process station 104 can then be pumped down to the same low pressure as the interior of process module 102, and process station 104 can be opened." (Col. 15, lines 19-35 and col. 16, lines 30-54.)

That is, the system of Davis et al. is not under a constant vacuum throughout the process module 102 and each of the processing stations 104, as is currently claimed, such that selective silicide formation in accordance with the present invention would not be achieved using the system of Davis et al. As supported by the present specification (specification, page 6, lines 21-28, page 7, lines 9-10, page 7, line 29 to page 8, line 2 and page, 9, lines 17-18), applicants' invention relies on the mainframe and interior cleaning and deposition chambers to be maintained, via a pump, under continuous, constant vacuum to reduce the criticality of time windows between steps for silicide formation.

However, the Examiner takes the position that it would have been obvious to one of ordinary skill in the art at the time the Applicants' invention was made to have provided

processing chambers inside of a process module in Koerner et al. and Chang et al. in order to prevent them from exposure to airborne particulates, vastly reducing the possibilities for particulate collection on wafers as taught by Davis et al.

Applicants disagree and continue to assert that the Examiner has not established a *prima facie* case of obviousness under the standards of 35 USC § 103(a).

It is respectfully submitted that it is well established law that citing references which merely indicate that isolated elements and/or features recited in the claims are known is not a sufficient basis for concluding that the combination of claimed elements would have been obvious, *Ex parte Hiyamizu* (BPAI 1988) 10 USPQ 2nd 1393, absent evidence of a motivating force which would impel a person skilled in the art to do what Applicant has done. *Ex parte Levengood* (BPAI 1993) 28 USPQ 2nd 1300. To properly combine two references to reach a conclusion of obviousness, there must be some teaching, suggestion or inference in either or both of the references, or knowledge generally available to one of ordinary skill in the art which would have led one to combine the relevant teachings of the two references. *Ashland Oil, Inc. v. Delta Resins and Refractories, Inc. et al.* (CAFC 1985) 227 USPQ 657. Both the suggestion to make the claimed composition or device or carry out the claimed process and the reasonable expectation of success must be founded in the prior art, not in Applicants' disclosure. *In re Vaech* (CAFC 1991) 20 USPQ 2nd 1438. The references used by themselves, and not in retrospect, must suggest doing what Applicant has done. *In re Skoll* (CCPA 1975) 187 USPQ 481.

Further, the fact that references are in the same art is an insufficient basis on which to combine the references. *In re Levitt* (CAFC 1989) 11 USPQ 2d 1315. It should be appreciated that the fact that a claimed product or process is within the broad field of the prior art and that one might arrive at it by selecting specific items and conditions does not render the product obvious in the absence of some directions or reasons for making such selection. *Ex parte Kuhn* (POBA 1961) 132 USPQ 359.

In summary, applicants submit that the Examiner has merely locating references that indicate isolated elements of applicants' invention, yet none of these cited references, alone or in any proper combination thereof, disclose or suggest the present invention, nor do they alone or in any combination provide any motivating force which would impel a person skilled in the art to do what applicants have done. *Ex parte Levengood* (BPAI 1993) 28 USPQ 2nd 1300. Applicants' position is evidenced further in the above office action, particularly in paragraphs 18 to 26, wherein the Examiner cites a number of other references to correct for deficiencies of the above cited references.

For example, Maydan et al. is cited for the deficiencies of Koerner et al., Chang et al. and Davis et al. not disclosing a vacuum chamber with an exhaust line, while Japanese Patent Publication No. 63-000480 A to Takebayashi et al. has been cited for the deficiencies of the combination of the previous references not disclosing a heating element external to the chamber. Yet, none of the cited references, alone or in any proper combination thereof, teach, suggest or infer, nor is there knowledge generally available to one of ordinary skill in the art which would have led one to combine the teachings of the

references to render applicants' claimed apparatus and system including a mainframe and interior cleaning and deposition chambers all under constant vacuum for selective silicide formation. *Ashland Oil, Inc. v. Delta Resins and Refractories, Inc. et al.* (CAFC 1985) 227 USPQ 657.

Applicants submit that the mere fact that components of the present invention are known does not render applicants' claimed apparatus and system unpatentable. Regarding the level of ordinary skill in the pertinent art, it is also submitted that appellants' invention is unobvious and would only be found based on appellants' own disclosure, which, of course, is improper as a hindsight reconstruction of the appellants' invention. *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 1553, 220 USPQ 303, 312-13 (Fed. Cir. 1983) (Hindsight based on reading of the patent in issue may not be used to aid in determining obviousness). Likewise, hindsight and the level of ordinary skill in the art may not be used to supply a component missing from the prior art references. *Al-Site Corp. v. VSI International, Inc.*, 174 F.3d 1308, 1324, 50 USPQ2d 1161, 1171 (Fed. Cir. 1999).

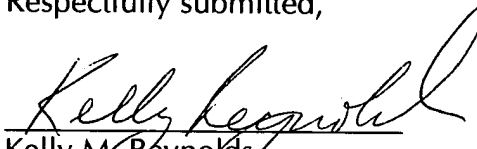
In view of the foregoing, and under the applicable law, it is respectfully submitted that the claims are properly allowable under 35 USC 103.

The cited McMillan patent does not overcome any of the above deficiencies.

It is for these reasons that applicants submit that the application is in a condition where allowance of the case is proper. Reconsideration and issuance of a Notice of Allowance are respectfully solicited. Should the Examiner not find the claims to be

allowable, Applicants' attorney respectfully requests that the Examiner call the undersigned to clarify any issue and/or to place the case in condition for allowance.

Respectfully submitted,


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